US009205898B2

(12) **United States Patent**
Schweiger

(10) **Patent No.: US 9,205,898 B2**
(45) **Date of Patent: Dec. 8, 2015**

(54) **FIN STRUCTURE FOR WATERCRAFT**

(71) Applicant: **Vlado Schweiger**, Postojna (SI)

(72) Inventor: **Vlado Schweiger**, Postojna (SI)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 102 days.

(21) Appl. No.: **13/754,265**

(22) Filed: **Jan. 30, 2013**

(65) **Prior Publication Data**

US 2014/0209006 A1 Jul. 31, 2014

(51) **Int. Cl.**

B63B 1/24 (2006.01)
B63B 35/79 (2006.01)
B63B 39/06 (2006.01)

(52) **U.S. Cl.**

CPC ***B63B 39/06*** (2013.01); ***B63B 35/7923*** (2013.01); ***B63B 35/7926*** (2013.01)

(58) **Field of Classification Search**

CPC B63B 1/24; B63B 1/248; B63B 1/28; B63B 1/20; B63B 1/242; B63B 39/06; B63B 35/7926; B63B 35/7923

USPC 114/274, 39.15, 39.24, 55, 54, 278, 114/126, 152; 441/74

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,410,872	A *	3/1922	Baldwin	114/20.1
2,890,672	A *	6/1959	Boericke, Jr.	114/274
6,499,419	B1 *	12/2002	Bussard	114/274
7,926,437	B2 *	4/2011	Townsend	114/274
2005/0287888	A1 *	12/2005	Balester	441/79

FOREIGN PATENT DOCUMENTS

FR	2832692	5/2003
WO	WO 9944884	9/1999
WO	WO 9965764	12/1999
WO	WO 0160690	8/2001
WO	WO 2009/100479	8/2009

OTHER PUBLICATIONS

"Doug Culnane's Blog" http://dougculane.blogspot.com/2014/08/diamond-foil-project.html (dated Aug. 28, 2005, retrieved from the internet by the examiner on Dec. 15, 2014).*

"Design and Build of a Surface Piercing Hydrofoil System", http://www.culane.net/dc/moth/prj/DiamondFoil/index.jsp, Internet Archive Wayback Machine capture of Aug. 25, 2007.*

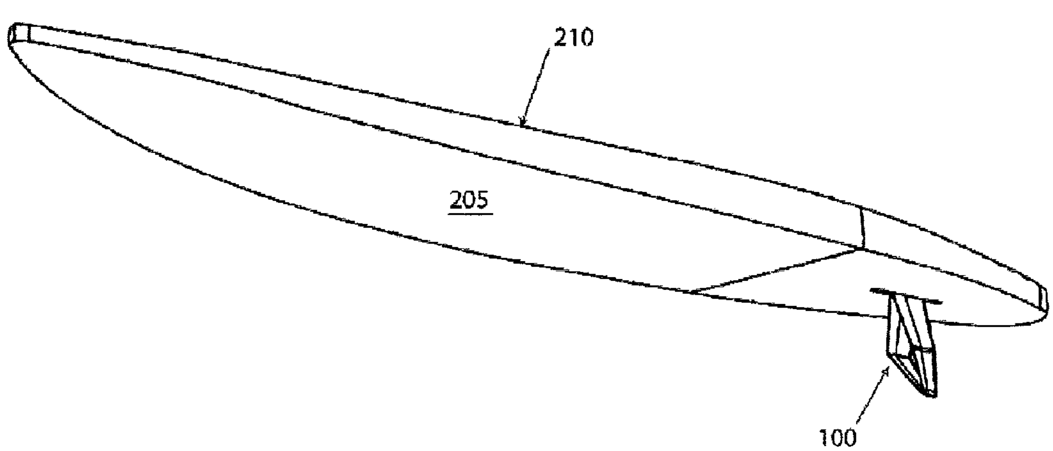
* cited by examiner

Primary Examiner — Anthony Wiest
(74) *Attorney, Agent, or Firm* — Leason Ellis LLP

(57) **ABSTRACT**

By way of overview and introduction what is disclosed is a fin structure for use with watercraft that is configured to provide lateral stability and generate hydrodynamic lift. The fin structure has a first end that can be connected to the underside of a hull. Two sidewalls extend away from the first end down into the water. As the side walls extend away from the hull, they also first diverge relative to one another and then converge to form a generally diamond shaped fin structure that is symmetric across the longitudinal axis and has an opening in between the sidewalls. Preferably, the sidewalls have a cross-section profile with an outer surface having more curvature than the inner surface. The shape of the fin structure provides lateral stability, hydrodynamic lift and maneuverability.

22 Claims, 8 Drawing Sheets



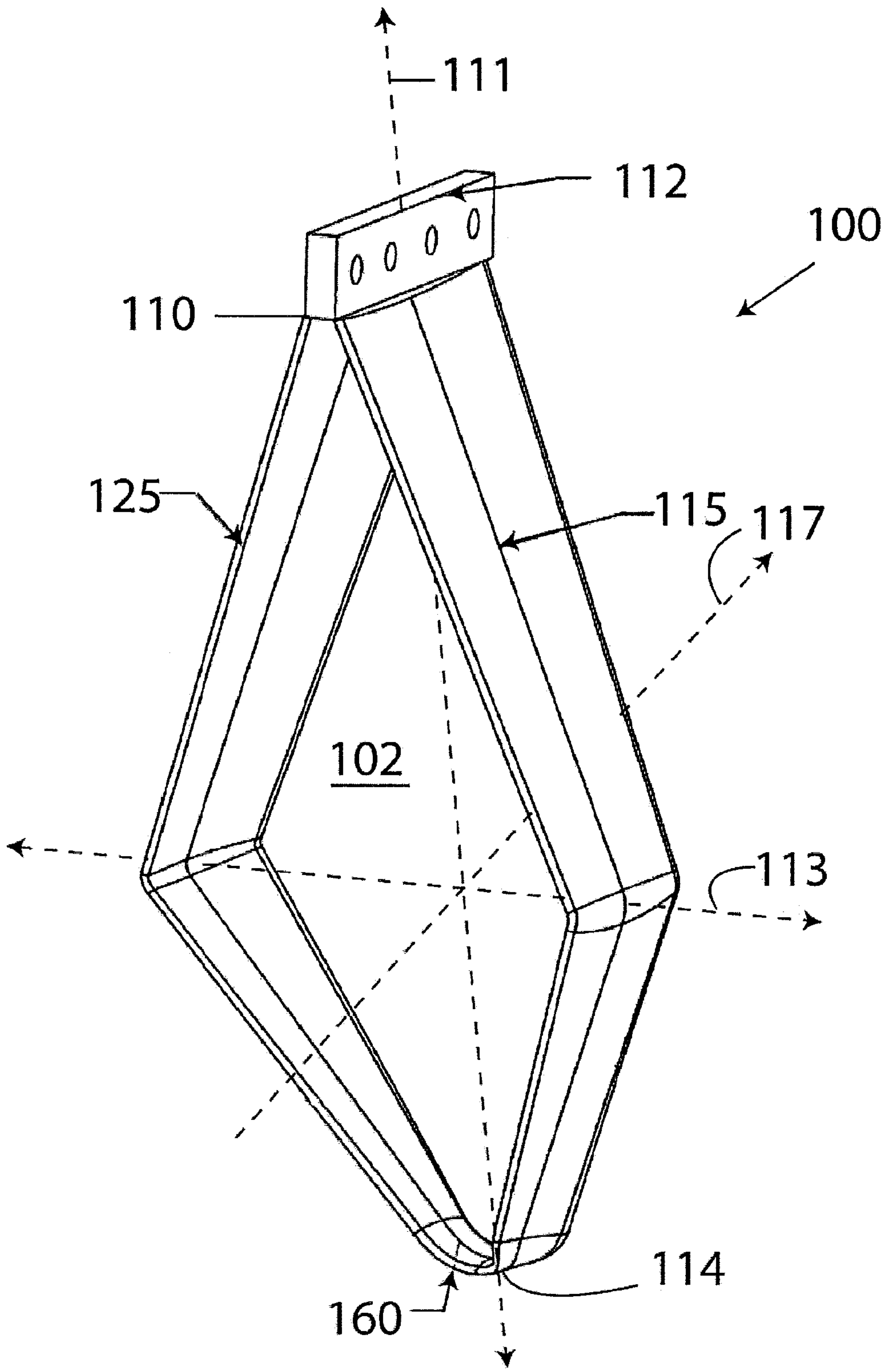


FIG 1

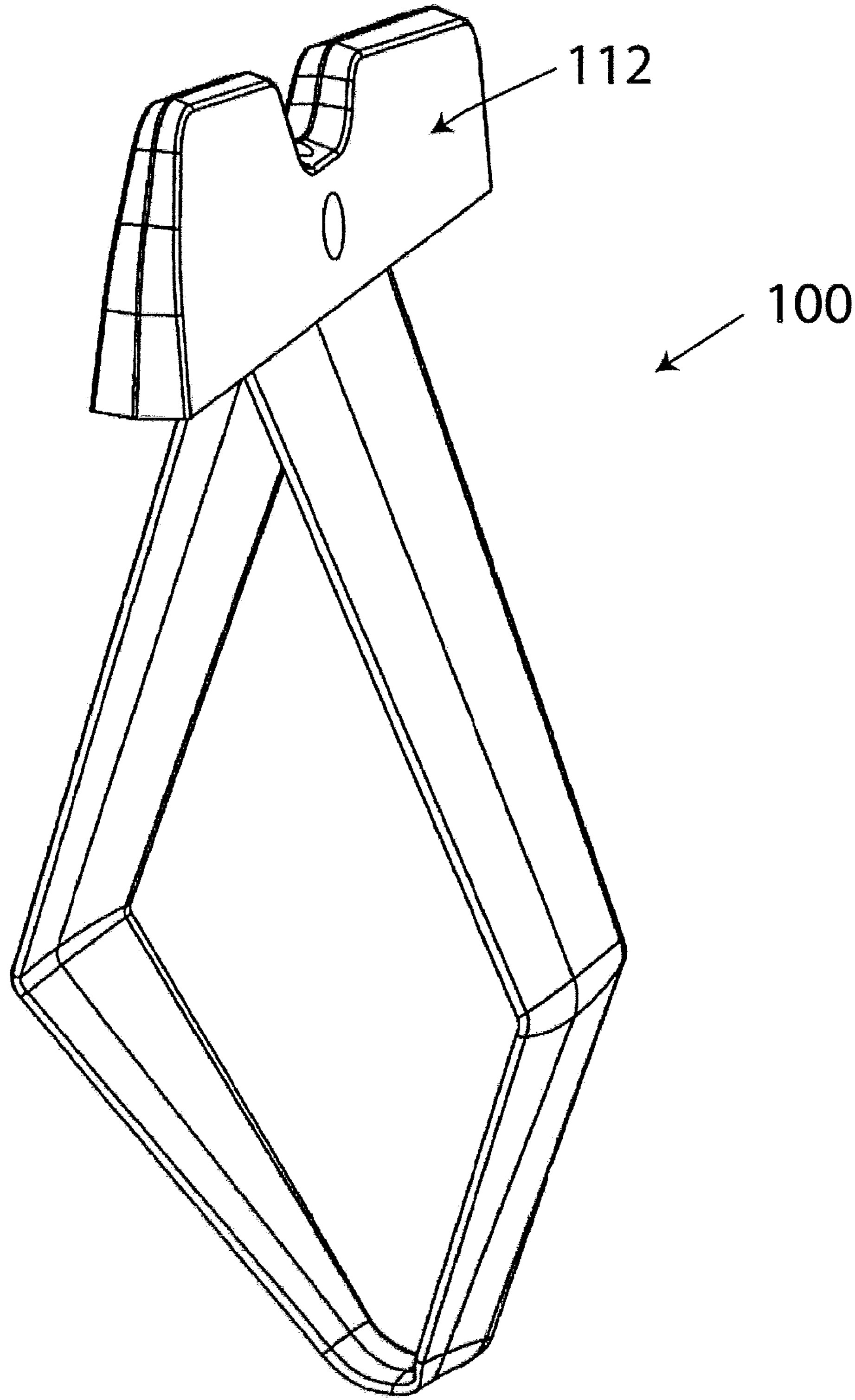


FIG 2A

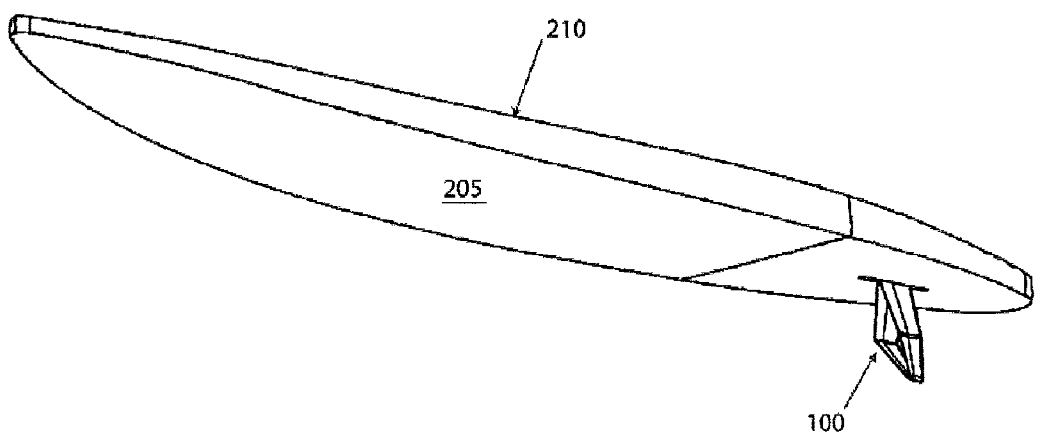


FIG 2B

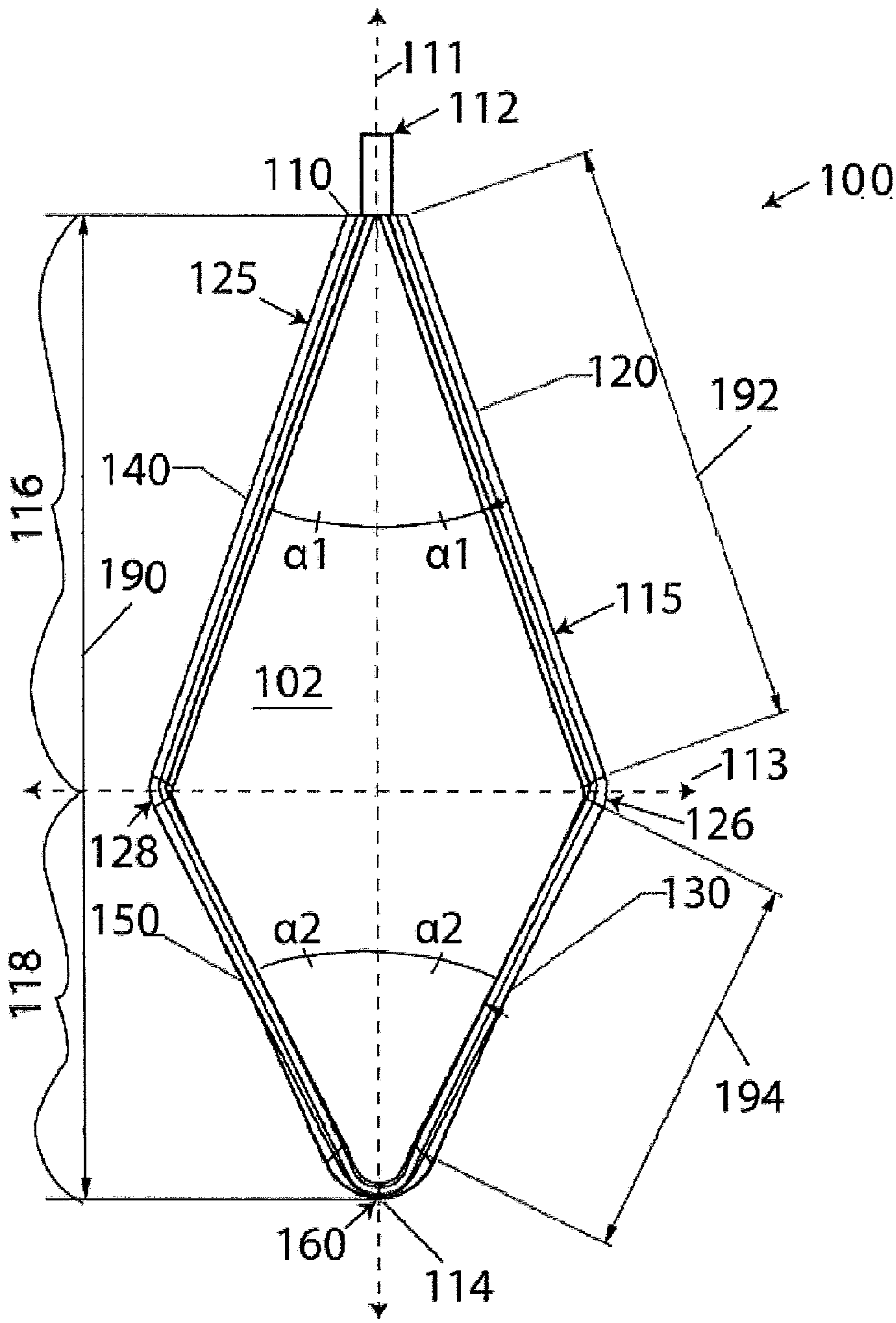

111
112
110
100
125
120
192
140
116
α1
α1
190
115
102
113
126
128
130
150
α2
α2
118
194
160
114

FIG 3

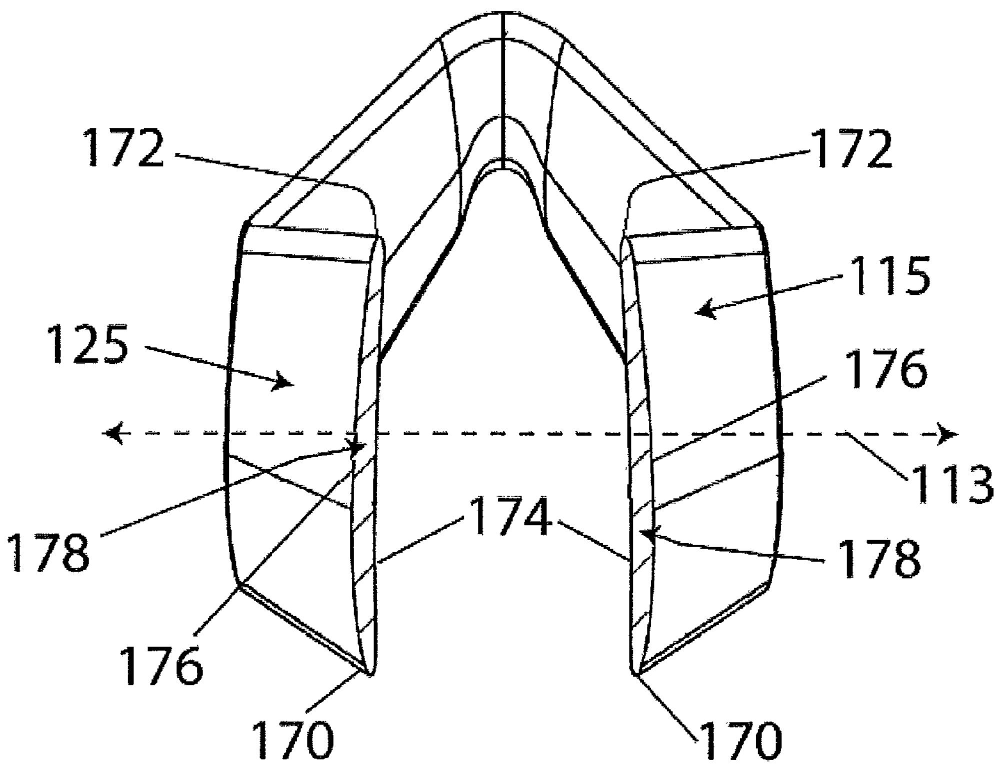


FIG 4A

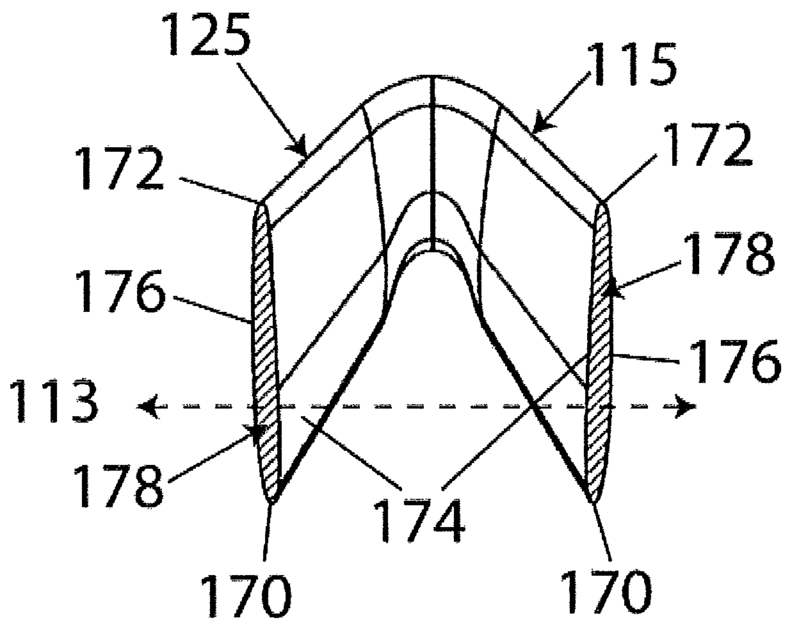


FIG 4B

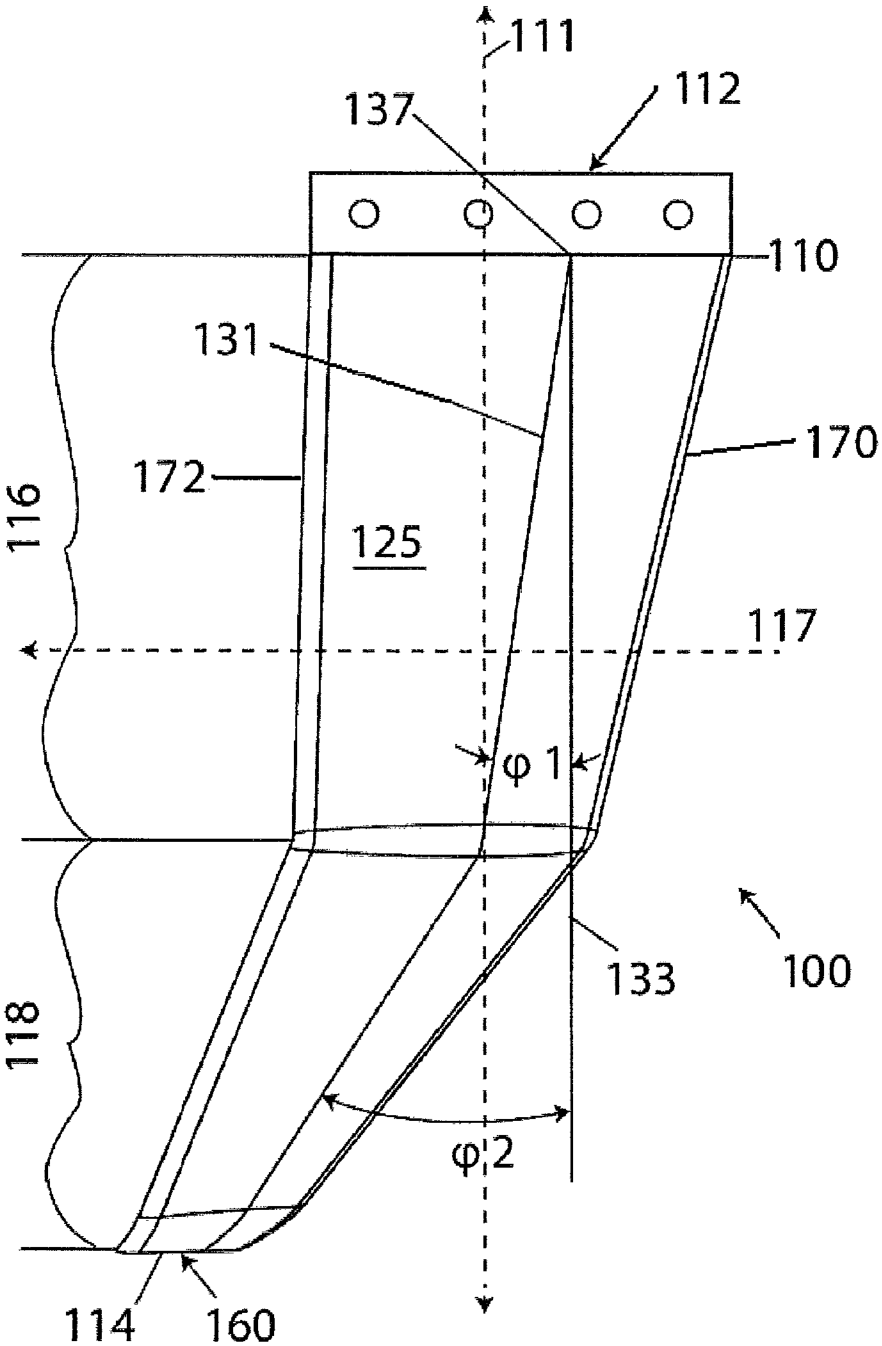


FIG 5

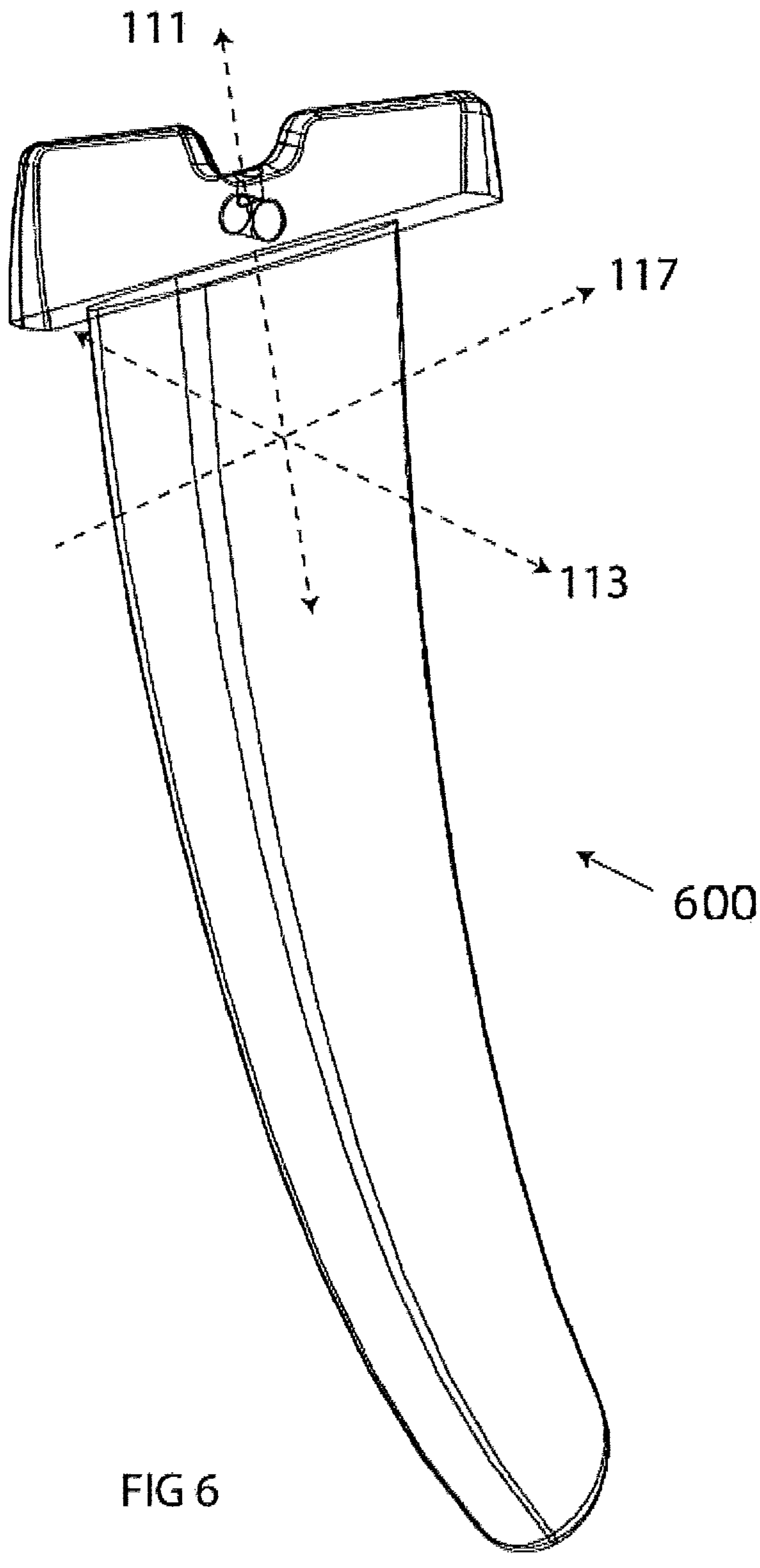


FIG 6

FIN STRUCTURE FOR WATERCRAFT

TECHNICAL FIELD OF THE INVENTION

This patent application relates generally to the field of watercraft and, in particular, a stabilizing fin for watercraft.

BACKGROUND OF THE INVENTION

Stabilizing fins are primarily used on a watercraft such as sail boats or any similar water going vessels which use a fin or keel and water sports boards such as surfboards, wind-surf boards, kite-surf boards, stand up paddle boards, wake boards and the like. Generally, surf boards, windsurf boards, SUP boards, wake boards and kite surfing boards have a fin or multiple fins attached to their bottoms that enable steering of the board and the ability to counteract the lateral force that tends to move the board in a lateral direction due to the direction of moving of the board on a wave.

In sail boats the main purpose of the keel is to counteract the force of the wind. On sail boats, the wind provides a force which enables the sail boat to move in its desired direction. The force which is caused by the wind is a lateral force which tends to tip the sailing boat.

When it is at rest, a watercraft's weight is borne entirely by the buoyant force of the watercraft. At low speeds generally the watercraft hull (or body, board, etc.) acts as a displacement hull, meaning that the buoyant force is mainly responsible for supporting the watercraft. As speed increases through the water, the shape of the hull causes hydrodynamic lift to increase as well. At some speed, hydrodynamic lift becomes the predominant upward force on the hull and the craft is "planing". Planing decreases drag on the body of the watercraft and allows for increased speed of the watercraft.

Standard fin structures for use in watercraft such as water sports boards generally have one or more single solid fin structures (i.e. not having any openings for the water to flow through) extending from the bottom of the watercraft into the water. Current standard fin structures generally extend along a vertical axis of symmetry and have a symmetrical profile across that axis. Standard fin structures can vary by having different depths, rake angles (extending in the direction of water flow), surface area and cross-section profiles that all depend on the purpose of the board and operating conditions and desired performance characteristics.

In the case of standard fin shapes, when moving through the water, water is flowing in the direction from the leading edge of the fin towards the trailing edge of the fin. In the vicinity of the fin, the water flow deflects and follows the shape of the fin. On each side of the fin, the local water velocity is increased relative to the hull which causes a pressure differential and lateral force is generated and acting on the surface of the fin, perpendicular to the axis of symmetry and direction of water flow. Because the cross section of standard fins have a symmetrical hydrodynamic profile, the lateral force is generated equally on the two opposing sides and act against each-other thereby giving lateral stability to the hull. Because the fin is moving through water, resistance force which occurs acting in the direction the water is flowing, causing what is commonly referred to as fin drag. In addition, because of the symmetric profile of the fin structure, no significant longitudinal force (hydrodynamic lift) is generated to counteract the force of gravity pushing the board into the water therefore does not get the board on plane more easily.

What is desired is a fin structure that provides lateral stability and generates hydrodynamic lift allowing the watercraft to get on plane more easily.

It is with respect to these and other considerations that the disclosure made herein is presented.

SUMMARY OF THE INVENTION

According to a first aspect, a fin structure for use in water is provided. The fin structure includes a body having a first end and opposite second end. The body has a first sidewall and a second sidewall that are at least partially spaced apart from one another so as to form an opening in between the two sidewalls. The sidewalls extend from first end toward the second end, and as the two sidewalls extend, the sidewalls diverge away from each other in the upper region. The two sidewalls then converge in the lower region. In addition, the fin structure can include a bottom portion that connects at least a portion of the first and second sidewalls.

According to another aspect, a fin structure for use in water is provided. The fin structure includes a body having a top end and a bottom end and a pair of sidewalls at least partially spaced apart from one another so as to define a through hole formed between the sidewalls. The through hole has: (1) a height measured along a longitudinal axis of the body that runs the length of the body and (2) a width measured along a horizontal axis that is perpendicular to the longitudinal axis. In addition, the height of the through hole is greater than the width of the through hole at any horizontal axis that is perpendicular to the longitudinal axis.

These and other aspects, features, and advantages can be appreciated from the accompanying description of certain embodiments of the invention and the accompanying drawing figures and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram illustrating a perspective view of an exemplary configuration of a fin structure according to an embodiment of the present invention;

FIG. **2**A is a diagram illustrating a perspective view of an exemplary configuration of a fin structure according to an embodiment of the present invention;

FIG. **2**B is a simplified diagram illustrating a perspective view of an exemplary configuration of a watercraft and fin structure according to an embodiment of the present invention;

FIG. **3** is a diagram illustrating a front view of an exemplary configuration of a fin structure according to an embodiment of the present invention;

FIG. **4**A is a diagram illustrating a cross-sectional view of an exemplary configuration of a fin structure according to an embodiment of the present invention;

FIG. **4**B is a diagram illustrating a cross-sectional view of an exemplary configuration of a fin structure according to an embodiment of the present invention;

FIG. **5** is a diagram illustrating a side plan view of an exemplary configuration of a fin structure according to an embodiment of the present invention; and

FIG. **6** is a diagram illustrating a perspective view of a standard fin structure.

DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS OF THE INVENTION

By way of overview and introduction what is disclosed is a fin structure for use with watercraft that is configured to provide lateral stability and generate hydrodynamic lift to counteract the force of gravity pushing the watercraft and the fin structure into the water and allow the watercraft to plane more easily. In a preferred arrangement the fin structure can be connected to the underside of a hull at a first end. Two sidewalls extend away from the first end down into the water (i.e. along a longitudinal (vertical) axis away from the underside of the hull). As the side walls extend away from the hull, they also first diverge relative to one another and then converge relative to one another to form a generally diamond shaped fin structure that is symmetric across the longitudinal axis and has an opening in between the sidewalls to allow water to flow through. Preferably, the sidewalls have a cross-section profile having outer surface of the sidewalls with more curvature than the inner surface. The symmetric shape of the fin structure provides lateral stability, while the asymmetrical cross-section creates hydrodynamic lift in the longitudinal direction and acting against gravity. In addition, maneuverability is increased.

The referenced systems and methods are now described more fully with reference to the accompanying drawings, in which one or more illustrated embodiments and/or arrangements of the systems and methods are shown. The systems and methods are not limited in any way to the illustrated embodiments and/or arrangements as the illustrated embodiments and/or arrangements described below are merely exemplary of the systems and methods, which can be embodied in various forms, as appreciated by one skilled in the art. Therefore, it is to be understood that any structural and functional details disclosed herein are not to be interpreted as limiting the systems and methods, but rather are provided as a representative embodiment and/or arrangement for teaching one skilled in the art one or more ways to implement the systems and methods.

FIG. **1** depicts a perspective view of a fin structure **100** according to an exemplary embodiment of the present invention. The fin has a first end **110** and a first sidewall **115** and a second sidewall **125**. The first and second sidewalls extend distally from the first end toward a second end **114** opposite the first end along a longitudinal axis **111** which bisects the first end and the second end. As the first and second sidewalls extend distally from the first end, they first diverge relative to one another along a horizontal axis **113** that is perpendicular to the longitudinal axis and also perpendicular to the direction of water flow **117**. As first and second sidewalls continue to extend, the first and second sidewalls then converge relative to one another along the horizontal axis to define an opening **102** therebetween. First and second sidewall can be integrally connected at the first end or separate at the first end.

In addition, the fin can include a bottom portion **160** that integrally connects the first and second sidewalls. In this exemplary variation of the disclosed embodiments, the bottom portion integrally connects the distal end of the first and second sidewalls such that the opening is completely bounded by the first and second sidewalls and the bottom portion. Alternatively, the bottom portion can integrally connect the first and second sidewalls at any location of the first and second sidewalls to define an opening that is bounded by a portion of the first and second sidewalls and the bottom portion. The bottom portion can be an arcuate shaped wall, however the bottom portion can take alternative shapes as would be understood by those skilled in the art. Moreover, preferably the bottom portion is bisected by the longitudinal axis **111**.

Preferably, the fin structure is symmetric across the longitudinal axis and as such the first sidewall **115** and the second sidewall **125** mirror one another (have identical yet reversed shapes).

Fin **100** can also include one or more mounts **112** located at the first end. Mount **112** has the primary purpose of connecting the fin structure to a vessel as would be understood by those skilled in the art. FIG. **2**A depicts an alternate configuration of mount **112**. It should be understood that the particular size and shape of the top end **110** (as depicted in FIG. **1**) and/or mount **112** can vary depending on the particular configuration of the fin (i.e., the shape of the fin as dictated by desired performance characteristics) and/or the application of the fin (i.e., the type of vessel the fin is attached to). Returning to FIG. **1**, as mentioned above, first and second sidewall can be integrally connected at the first end or alternatively separate at the first end. Moreover, first and second sidewall can be integrally connected to mount **112** or shaped to define mount as would be understood by those skilled in the art.

Turning briefly to FIG. **2**B, a watercraft **210** is depicted which in this exemplary embodiment is a surfboard. The fin **100** is attached to the underside **205** of the surfboard. In practice, the surfboard is placed onto the water surface with the underside down such that the fin is at least partially submerged in the water. When the fin is mounted to the vessel at least a portion of the mount (not shown) can be not visible.

In reference to FIG. **3** which depicts a front plan view of fin structure **100** according to an exemplary embodiment of the present invention, first sidewall **115** can include a first upper sidewall **120** and first lower sidewall **130**. Similarly, second sidewall **125** can include a second upper sidewall **140** and second lower sidewall **150**. At least first upper sidewall and second upper sidewall define an upper region **116** of the fin. Similarly, at least first lower sidewall and second lower sidewall define a lower region **118** of the fin **100**. First upper sidewall and first lower sidewall can define a first transition **126** at the intersection of the upper and lower regions. Similarly, second upper sidewall and second lower sidewall can define a second transition **128** at the intersection of the upper and lower regions. Preferably, the first and second intersections have an arcuate shape. The radius of curvature of the first and second transition can be varied and it should be understood that the first and second transitions can have other possible shapes, including but not limited to a single defined angle, or multi angle transition as would be understood by those skilled in the art.

Preferably, mount, first and second sidewalls and bottom portion are made from the same material, however a combination of materials can be used. In addition, the fin structure can be made from multiple pieces. One or more pieces of the fin structure can also be made by multiple pieces joined together by heat welding, glue or other adhesive, fasteners, joints or other suitable temporary or permanent joining means. Alternatively, one or more pieces of the fin structure can be formed as a single structure. Preferably, the fin structure is made of a light sturdy plastic, such as acrylonitrile-butadiene-styrene copolymer, polyethylene, polyvinyl chloride, polycarbonate, polyproplene or styrene and the like. It may, however, be made from any strong, sturdy and water resistant material, such as metals, composites, fiberglass and the like as would be understood by those skilled in the art.

In this exemplary embodiment, fin **100** has a generally diamond shape with a generally diamond shaped opening **102**. More specifically, first upper sidewall **120** and second upper sidewall **140** each generally extend from the first end **110** along the longitudinal axis **111** and the horizontal axis **113** at the angle $\alpha 1$ relative to the longitudinal axis **111**. Preferably angle $\alpha 1$ is within the range of 0 to 75 degrees, and can be varied according to the desired hydrodynamic characteristics of the fin. Preferably, and without limitation, the first and second upper sidewalls have an identical length **192** which is greater than 0 and less than the depth **190** of the fin **100**. First lower sidewall **130** and second lower sidewall **150** extend from the distal end of the first upper sidewall **120** and second upper sidewall **140**, respectively at an angle $\alpha 2$ relative to the longitudinal axis. Preferably, the length **194** of the first and second lower sidewalls is identical and is a function of the fin depth **190**, length **192** and angles $\alpha 1$ and $\alpha 2$. In addition length **194** can also be a function of the dimensions of the bottom portion **160**.

Turning now to FIG. **4**A, which depicts an exemplary cross-section of the first sidewall **115** and second sidewall **125** taken in a transverse direction in the upper region of the fin **100**. Each of the first and second sidewalls include a leading edge **170**, a trailing edge **172**, an inner surface **174** and an outer surface **176**, which define the cross-section **178** of each the first and second sidewalls in the upper region of the fin **100**. Turning briefly to FIG. **4**B, which depicts an exemplary cross sectional view of the first sidewall **115** and second sidewall **125** in the lower region. Each of the first and second sidewall include a leading edge **170**, a trailing edge **172**, an inner surface **174** and an outer surface **176**, which defines the cross-section **178** of the first and second sidewalls in the lower region (not pictured). It should be understood that, preferably, the cross-section of first and second sidewalls, when taken in the transverse direction at the same point along the longitudinal axis, mirror one another (have identical yet reversed shapes). It should also be understood that the leading edge **170**, trailing edge **172**, inner surface **174** and outer surface **176** can continue through the transitions between the upper region, lower region and bottom portion **160** of fin **100** and as such, all constituent elements in the upper and lower regions of the fin structure have a cross-section **178**.

Referring now to FIGS. **4**A and **4**B, preferably, cross-section **178** when taken in a transverse direction at any point on the longitudinal axis has an asymmetric shape. The particular asymmetric cross-section shape can be varied according to the desired performance characteristics of the fin **100**. The particular shape of the cross-section of the first and second sidewalls taken in a transverse direction can vary from one point along the longitudinal axis to another as a function of the distance between the leading edge **170** and trailing edge **172**, as well as the particular shape of the outer surface **176** or inner surface **178** at that particular point. Furthermore, it is preferable that in at least the upper region, the radius of curvature of the outer surface is greater than the radius of curvature of the inner surface.

The particular shape of the cross-section **178** for the various portions of the first and second sidewall, transitions and bottom portion **160** of the fin vary depending on the desired performance characteristics of the fin **100**. The main purpose of the fin is to provide stability of the board and better guidance during maneuvers and tricks on the water. More specifically, the performance of the fin generally depends of fin depth (i.e., length **190**), fin rake angle, cross-section **178** and the surface area of the fin. The variations of cross-section shapes, including sidewall curvatures that can affect hydrodynamic lift, maneuverability and other performance characteristics would be understood by those skilled in the art. For example, in the upper region, the outer surface can have a greater curvature than the inner surface to provide hydrodynamic lift; in addition, for at least a portion of the lower region, the radius of curvature of the outer surface can be greater than the inner surface to provide some downward hydrodynamic force, in addition, the radius of curvature of the remaining pieces of the lower region including the bottom portion **160** can have an inner surface with a greater radius of curvature than the outer surface to provide hydrodynamic lift, generating a net lifting effect by the fin.

Although the disclosed embodiments of the present invention describe a fin **100** that is symmetric across the longitudinal axis it should be understood that, depending on the desired performance characteristics, the fin can be asymmetrical and first and second sidewalls and/or bottom portion can have non-mirrored cross-sections when taken in the transverse direction at the same point along the longitudinal axis. For example, non-symmetric fin shape may be desirable if, say, the fin needs to pull in a particular horizontal direction more.

In reference to FIG. **5**, which is a side plan view of fin **100**, second sidewall **125** and first sidewall (not pictured because hidden behind second sidewall) can extend in the direction of the water flow **117** at one or more rake angles. As discussed above, the direction of water flow is perpendicular to both the longitudinal axis **111** and horizontal axis (not pictured). In this exemplary embodiment, first and second sidewalls extend in the direction of water flow at a first rake angle $\phi 1$ in the upper region **116**. In addition, the first and second sidewalls extend in the direction of water flow at a second rake angle $\phi 2$ in the lower region **116**. Rake angle is measured between (a) the rake line **131** defined by the outermost portion of the outer surface relative to the longitudinal axis and a reference line **133** which is drawn parallel to the longitudinal axis from the point where the rake line begins at the first end **110**. Preferably, first rake angle and second rake angle can range in value between 0 and 75. It should be understood that although this exemplary embodiment is described as having two rake angles, the fin can have any number of rake angles. In addition or alternatively the first and second sidewalls can also have continuously varying rake angle such as a curved shape as would be understood by those skilled in the art. In addition, as depicted in FIG. **5**, the distance between the leading edge **170** and trailing edge **172** of the sidewalls can be varied to adjust performance characteristics of the fin.

In practice, the direction of water flow **117** is from the leading edge **170** of the fin **100** towards the trailing edge **172**. In the vicinity of the fin the water flow deflects around the fin and follows the shape of the fin. Because the cross-section of the fin is a hydrodynamic profile the disclosed embodiment generates beneficial performance characteristics

In a standard shaped fin **600**, as depicted in FIG. **6**, symmetrical profiles are generally used. As the water moves past the fin **600** in the water flow direction **117**, the local velocity is increased across the surface of the fin relative to the fin itself which causes a pressure differential and lateral force is a generated on sides, opposing each other, acting in the horizontal direction **113** which gives stability to a board. Because the fin is moving through water also a resistance force occurs acting in the direction of water flow **117** (i.e. fin drag).

In the practical application of a standard shaped fin **600** on, say, a surfboard, the board itself must be buoyant to counteract gravity and keep the board and a surfer standing on the board afloat. The board itself is buoyant and floats on the water with the surfer on it the weight is increased and extra lift is needed to stay on the surface. When the board is moving the board shape generates hydrodynamic lift force in the longitudinal direction which supplements buoyancy and keeps the board and surfer on the surface. The greater the speed of the board, the greater the hydrodynamic lift is generated. As explained, standard fins moving through the water provide extremely small hydrodynamic lift or in most cases no hydrodynamic lift at all to counteract gravity.

In practical application of the fin structure **100** as described in relation to FIGS. **1-5**, because of its asymmetric cross-section **178**, provides hydrodynamic lift in the longitudinal direction **111** with increasing speed of the board, while because of the symmetric shape of the fin **100** provides lateral stability in the horizontal direction **113**. Moreover, the symmetric shape and opening **102** and cross-section shape results in relatively less drag force acting in the direction of water flow **117**.

For example, provided two equal boards, the first having a standard fin shape and the second having a fin **100** according to the disclosed embodiments, the second board will plane sooner. Moreover, the second board should have relatively better control and maneuverability on turns. More specifically, with a standard fin on a turn, the board is deflected and also is the fin (i.e., the board and fin are rotated about the direction of water flow **117**). Because of the rotation, the surface area which provides lateral force in the horizontal direction **113**, is reduced. The greater the deflection of the board and the fin, the greater the reduction of the surface area providing lateral force and consequently a decrease in lateral force which provides stability. However, when a turn is made using fin **100**, significant lateral force is maintained because the generally diamond shape maintains significant surface area that is laterally inclined (i.e., oriented generally along the longitudinal axis **111**) and providing lateral force. When upright (i.e., inclined in the longitudinal axis), the upper first sidewall **120**, lower first sidewall **130** oppose the upper second sidewall **140** and lower second sidewall **150**. In a turn, where the axis of rotation is the water flow direction **117** and we rotate the fin in a counterclockwise direction, than the upper second sidewall **140** and lower first sidewall **130** move toward alignment in the longitudinal axis **111**. Accordingly, upper second sidewall **140** and lower first sidewall **130** oppose one another and provide a full surface on which lateral force in horizontal direction **113** is generated. In addition, the use of asymmetric profile adds to better maneuverability. Varying the length and cross-section of upper first sidewall **120**, lower first sidewall **130**, lower second sidewall **150**, upper second sidewall **140** as well as angles $\alpha 1$, $\alpha 2$, rake angles and other physical attributes of fin **100** can adjust the performance characteristics of fin **100** including the amount of hydrodynamic lift, stability, drag and maneuverability as would be understood by those skilled in the art.

Thus, while there have been shown, described, and pointed out fundamental novel features of the invention as applied to several embodiments, it will be understood that various omissions, substitutions, and changes in the form and details of the devices illustrated, and in their operation, may be made by those skilled in the art without departing from the spirit and scope of the invention. Substitutions of elements from one described embodiment to another are also fully intended and contemplated. It is also to be understood that the drawings are not necessarily drawn to scale, but that they are merely conceptual in nature. The invention is defined solely with regard to the claims appended hereto, and equivalents of the recitations therein.

What is claimed:

1. A fin structure for use attached to a water sports board, comprising:

a body having a first end and opposite second end, the body being defined by a first sidewall and a second sidewall that are at least partially spaced apart from one another so as to define a single generally kite-shaped opening therebetween, wherein the first and second sidewalls extend distally from the first end toward the second end to define an upper region and a lower region, wherein in a direction from the first end towards the second end, the first and second sidewalls initially diverge relative to one another to define equal length first segments so as to comprise the upper region and then converge relative to one another to define equal length second segments so as to comprise the lower region wherein the first segments have a length that is greater than the second segments such that the upper region is taller than the lower region, and

the body further comprising a bottom portion comprising an arcuate shaped wall and integrally connecting the first and second sidewalls at the second end,

wherein the first and second sidewalls intersect at the first end and are symmetric relative to a longitudinal axis that bisects the first end and the bottom portion,

wherein each of the first and second sidewalls have an inner surface and an outer surface opposite to the inner surface defining a cross-section, wherein the outer surface has a greater radius of curvature than the inner surface in the upper region and wherein the outer surface of the sidewalls in at least a portion of the lower region has a greater radius of curvature than the inner surface,

wherein the body has a maximum height that is greater than a maximum width of the body; and

a mount disposed at the first end of the body, wherein the mount is configured to attach the kite-shaped body to a bottom surface of the water sports board.

2. The fin structure of claim **1**, wherein the opening is continuously bounded by the first and second sidewalls and the bottom portion.

3. The fin structure of claim **1**, wherein the longitudinal axis bisects the intersection of the first and second sidewall at the first end and bisects the arcuate bottom portion integrally connecting the first and second sidewall at the second end.

4. The fin structure of claim **1**, wherein the mount is configured to mount the body to a bottom surface of the water sports board such that the body extends from the bottom surface.

5. The fin structure of claim **4**, wherein the mount is disposed above an intersection of the first and second sidewalls and is configured to mount the body to the bottom surface of the watersports board such that the kite-shaped body is adjacent to the bottom surface of the board.

6. The fin structure of claim **4**, wherein the first and second sidewalls are integrally connected to the mount.

7. The fin structure of claim **1**, wherein the first and second sidewalls diverge at a first angle in the upper region.

8. The fin structure of claim **7**, wherein the first angle is between 0 and 75 degrees relative to a longitudinal axis, wherein the longitudinal axis bisects the first end and the second end.

9. The fin structure of claim **1**, wherein the first and second sidewalls converge at a second angle in the lower region.

10. The fin structure of claim **9**, wherein the second angle is between 0 and 90 degrees relative to a longitudinal axis, wherein the longitudinal axis bisects the first end and the second end.

11. The fin structure of claim **1**, the first and second sidewalls each having a transition at the intersection of the upper and lower regions.

12. The fin structure of claim **11**, wherein the transition is arcuate.

13. The fin structure of claim **1**, wherein the bottom portion integrally connects a distal end of each of the first and second sidewalls.

14. The fin structure of claim **1**, wherein the opening is formed completely and continuously from the first end to the bottom section.

15. The fin structure of claim **1**, wherein each of the first and second sidewalls have a leading edge, a trailing edge opposite to the leading edge, an inner surface and an outer surface opposite to the inner surface defining a cross-section.

16. The fin structure of claim **1**, wherein the bottom portion has a leading edge, a trailing edge opposite to the leading edge, an inner surface and an outer surface opposite to the inner surface.

17. The fin structure of claim **16**, wherein a cross-section, taken in a transverse direction, of each of the first and second sidewalls is asymmetric.

18. The fin structure of claim **16**, wherein the first and second sidewalls extends in the direction of the trailing edge of the first and second sidewalls at a first rake angle at the upper region.

19. The fin structure of claim **16**, wherein the first and second sidewalls extend in the direction of the trailing edge of the first and second sidewalls at a second rake angle at the lower region.

20. The fin structure of claim **1**, wherein the body in the upper region is substantially taller than the body in the lower region.

21. A fin structure for use with a water sports board, comprising:

a body having a top end and a bottom end and a pair of sidewalls at least partially spaced apart from one another so as to define a single continuously bounded generally kite-shaped opening therebetween, the opening having: (1) a height measured along a longitudinal axis of the body that runs a length of the body and that bisects the top end and the bottom end and (2) a width measured along a transverse axis that extends though the first and second spaced sidewalls and is perpendicular to the longitudinal axis, wherein the height is greater than the width of the opening at any transverse axis, the body further comprising an arcuate shaped wall at the bottom end integrally connecting the pair of sidewalls,

wherein the sidewalls intersect at the top end and are symmetric relative to the longitudinal axis and wherein the sidewalls diverge at a first angle in the upper region and converge at a second angle in the lower region, whereby the body and the opening defined by the so configured sidewalls and bottom portion are kite-shaped and wherein the body in the upper region is taller than the body in the lower region;

wherein the sidewalls each have an inner surface and an outer surface opposite to the inner surface defining a respective cross-section, wherein the outer surface of the sidewalls have a greater radius of curvature than the inner surface in the upper region and wherein the outer surface of the sidewalls in at least a first portion of the lower region has a greater radius of curvature than the inner surface; and

a mount disposed at the top end of the body, wherein the mount is configured to attach the body to a bottom surface of a water sports board such that the body extends from the bottom surface.

22. The fin structure of claim **21**, wherein the outer surface of the sidewalls in at least a second portion of the lower region have a smaller radius of curvature than the inner surface.

* * * * *